What is claimed is:

1. A system for determining the constituents of a sample, the system comprising:

a femtosecond terawatt laser radiation source configured to emit laser radiation through a sample;

an optical unit configured to receive light backscattered from the sample; and

a detection and analysis unit coupled to said optical unit for analyzing a spectral signature of the sample.

2. The system of claim 1, further comprising an optical fiber cable coupling said optical unit to said detection and analysis unit.

3. The system of claim 1, wherein said detection and analysis unit comprises an integrated diagnostic unit having one or more infrared and UV/VIS spectrometers with gated detection capability, two photo-multipliers attached to an air transient digitizer, and a data acquisition control unit.

4. The system of claim 1, wherein said detection and analysis unit further comprises a real-time computing system for identification and discrimination of at least one of the group comprising: aerosols, airborne bacteria, viruses, toxins, dust particles, pollen, water droplets, gaseous agents, and pollutants.

5. The system of claim 1, wherein said femtosecond terawatt laser radiation source is amplified by chirped pulse amplification.

6. The system of claim 1, wherein said femtosecond terawatt laser radiation source is a Ti:Sapphire laser configured to emit energy of approximately 300 mJ per pulse.

7. The system of claim 6, wherein said femtosecond terawatt laser radiation source has a pulse power of about approximately 3 and 4 TW with a pulse duration approximately of the order of 80 to 100 fs and a repetition rate of approximately 10 Hz.

8. The system of claim 1, wherein said femtosecond terawatt laser radiation source emits light within a spectral range approximately centered at 800 nm or 267 nm with a spectral width of approximately 20nm.

9. The system of claim 1, wherein said femtosecond laser radiation source emits laser pulses at a center wavelength of approximately 800nm and spectral width of 20 nm to create plasma filaments; and

wherein said femtosecond laser radiation source emits laser pulses at a wavelength of approximately 267nm.

10. The system of claim 1, wherein the detection and analysis unit is configured to detect airborne biological, chemical agents and water droplets by at least one technique chosen from the group comprising: differential absorption, Raman Raleigh and Mie scattering, fluorescence, flourescence LIDAR measurements, ground-based LIDAR measurements, air-based LIDAR measurements, and Raman LIDAR measurements.

11. The system according to claim 1, wherein the detection and analysis unit is configured to provide 3D maps of detected molecules.

12. A method for determining the constituents within a sample, the method comprising the steps of:

providing a femtosecond terawatt laser radiation source configured to emit laser radiation through a sample;

capturing light backscattered from the sample; and

analyzing a spectral signature of the sample to determine its constituents.

13. The method of claim 12, wherein the analyzing step determines whether the constituents include least one of the group comprising: aerosols, airborne bacteria, viruses, toxins, dust particles, pollen, water droplets, gaseous agents, and pollutants.

14. The method of claim 12, further comprising the step of amplifying the femtosecond terawatt laser radiation source using chirped pulse amplification.

15. The method of claim 12, wherein the femtosecond terawatt laser radiation source is a Ti:Sapphire laser configured to emit energy of approximately 300 mJ per pulse.

16. The method of claim 12, further comprising the step of pulsing the femtosecond terawatt laser radiation source at a power of about approximately 3 and 4 TW with a pulse duration approximately of the order of 80 to 100 fs and a repetition rate of approximately 10 Hz.

17. The method of claim 12, wherein the femtosecond terawatt laser radiation source emits light within a spectral range approximately centered at 800 nm or 267 nm with a spectral width of approximately 20nm.

18. The method of claim 12, wherein said femtosecond laser radiation source emits laser pulses at a center wavelength of approximately 800nm and spectral width of 20 nm to create plasma filaments; and

wherein said femtosecond laser radiation source emits laser pulses at a wavelength of approximately 267nm.

19. The method of claim 12, wherein the analyzing step uses at least one technique chosen from the group comprising: differential absorption, Raman Raleigh and Mie scattering, fluorescence, flourescence LIDAR measurements, ground-based LIDAR measurements, air-based LIDAR measurements, and Raman LIDAR measurements.

20. A method according to claim 12, wherein the detection and analysis unit is configured to provide 3D maps of detected molecules.

21. A method according to claim 12, further comprising the step of comparing at least one of detected vibrational bands, detected Raman spectra, and fluorescence spectra, with previously measured spectral data to identify the constituents within the sample.

22. A system for determining the constituents within a sample, the system comprising:

means for providing a femtosecond terawatt laser radiation source configured to emit laser radiation through a sample;

means for capturing light backscattered from the sample; and

means for analyzing a spectral signature of the sample to determine its constituents.